SHEDD AQUARIUM

Providing Forever Homes

LESSON TWO: Otter Enrichment Design Challenge

All animals have certain behaviors that help them to survive in the wild. For example, sea otters forage for food on the ocean floor and use rocks to crack open hard shells to eat the animals inside. When Shedd Aquarium recues an animal that can no longer survive in the wild, like sea otter Luna, we need to know everything about how it behaves. How does this animal find its food? When and where does it rest? How does it interact with its environment, and what senses does it use the most? When we know these things, we can provide a forever home for a rescued animal that fulfills all of its needs. Animal care experts at Shedd Aquarium spend time observing animals' behaviors to learn more about them and then create habitats that allow those animals to be themselves. This lesson will give you the chance to take on the role of animal care expert by observing animal behaviors and designing enrichment items to give them the mental and physical exercise that they would get in the ocean.

LESSON TWO: Otter Enrichment Design Challenge

CONNECTION TO UNIT: Why this matters for your students

Science students need to have a foundational understanding of the engineering design process as well as skill at interpreting data. This lesson focuses on NGSS Science and Engineering Processes. Students will use their own observations and data collection to create and redesign a model as a possible solution to a common puzzle that Shedd's marine mammals trainers face regularly. Shedd cares for the health of our animals. It is important to provide them with physical and mental stimulation. What better way to do this than with a custom-designed toy?

NGSS SCIENCE AND ENGINEERING PRACTICES

Developing and using models

> Modeling in 6-8 builds on K-5 experiences and progresses to developing, using and revising models to describe, test and predict more abstract phenomena and design systems.

Analyzing and interpreting data

> Analyze and interpret data to provide evidence for phenomena.

Constructing explanations and designing solutions

> Construct an explanation that includes qualitative or quantitative relations between variables that predict phenomena.

Engaging in argument from evidence

> Construct a written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.

> Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.

KEY POINTS

Students will

> understand why Shedd provides enrichment items to animals as a means to keep our animals healthy.

> be able to use the engineering design process to create a solution to a real scientific issue.

> be able to create bar graphs and pie charts from collected data.

> be able to interpret data to inform scientific decision making.

> be able to compare and contrast qualitative and quantitative data.

MATERIALS/SETUP

> Student handout (one per student)

> Sea otter behavior video

AGENDA

1. Engage (5 min)
2. Explore (15 min)
3. Explain (10 min)
4. Elaborate (15 min)
5. Evaluate (5 min)

Additional time can be given to complete or create real models of enrichment items.

IMPORTANT VOCABULARY

> Enrichment item

> Quantitative

> Qualitative

> Bar graph

> Pie chart

> Ethogram

ENGAGE: Key points previewed

Grab students' attention, recall prior knowledge and set framework for today's lesson.

In this section, you will give your students a photograph of a rescued otter (on handout) that Shedd Aquarium is providing a forever home for. You will also present your students with a challenge. Their challenge is to design a sea otter enrichment item. An enrichment item is defined as a toy or object that keeps the animals' minds active and engaged. This should be framed with students before they being to design their item.

EXPLORE: Key points discovered

Students conduct a mini investigation to challenge or confirm initial model. They should make observations, collect/record data and interpret their results.

During this section students will watch a short video clip to collect data on Shedd Aquarium sea otter behavior to improve their initial enrichment designs. Look for the Explore section on student handout; students should complete the table during the video.

> While watching the video, students will record data in an ethogram. If the students are watching the video as a full group, you may pause the video clip every 5 seconds for students to record their data. If students have individual laptops or tablets, they can control their time. It is recommended that they pause every 5-10 seconds. Make sure to use the same time interval for the entire activity.

EXPLAIN: Key points formalized

Students are guided toward creating explanations of their results. Here is where they really connect their investigation back to the content. Key vocabulary, scientific principles and theories are introduced. Additional sense-making activities may be used or can be follow-up questions/discussion.

Students will use this space to organize the data from the ethogram about what behaviors are most common. Look at the Explain section of the student handout.

Students will learn the definitions of quantitative and qualitative data and apply them to the experiment at hand.

> After students have collected their data, they will pick the four most common behaviors. These behaviors should be organized into a table where they list the behavior as well as the percentage of time the otter spent doing that behavior.

> After they have created their summary table, the students should create a bar graph and pie chart of Shedd Aquarium sea otter behavior. Help has been provided for creating the pie chart by guiding questions and steps to help students calculate their percentages. Students might need more guidance here.

ELABORATE: Key points used

Students continue to complete practice problems of skills and/or apply new knowledge to the situation or new scenario. Teacher checks student comprehension and push extension of content.

Students will answer Elaborate questions 1–4. These can be done individually or in small groups. If students answer questions individually, then questions should be discussed after to make sure all students are on the same page and any misconceptions are caught.

Student exemplar responses to questions could include:

1. The otters seem to groom their fur a lot. If they spend so much time on it, it must be important to their health.
2. Grooming (supported with specific quantitative data from ethogram)
3. Open ended.
4. Scientists support their claims with data to support their answer. Science needs experiments to prove that what someone is saying is true.

EVALUATE: Key points assessed

In this section, both students and teacher check students' acquisition of knowledge. Students should gain a clear understanding of what they have learned. As the teacher, you can use this information to begin to formulate the next day's lesson.

Students design their new enrichment item and answer the reflection questions in the Evaluate section of the student handout.

OPTION 1:

Have students exchange their Shedd sea otter enrichment item designs and give feedback to each other.

OPTION 2:

Have students reflect on the engineering design process of their Shedd sea otter enrichment items.

> How did performing research change your design?

> Why is it important to create an initial design, but be willing to change it?

NOTES/CONSIDERATIONS

This lesson can be done independently, in groups, or a combination of both.

Teacher will need to be able to play a video clip.

Some prior knowledge of bar graphs and pie charts is needed for this lesson. To prepare, students could be briefly shown examples of bar graphs and pie charts to familiarize them with the concept. Additional assistance may be needed when working with these graphs during the lesson.

We would love to learn from you!

Please take a moment to share your thoughts about the NextGen Animal Responders curriculum. You can complete our brief survey—and boost Shedd learning—at **http://bit.ly/NextGenSurvey**.

SHEDD AQUARIUM

Sea Otter Exhibit Designer Challenge

STUDENT HANDOUT

Name _____ Class period: _____

Your mission: As a marine mammals trainer, you will need to design appropriate enrichment for sea otters. An enrichment item is like a toy to keep animals' brains active and engaged.

ENGAGE

Background information: Sea otters are curious by nature. They like to explore and handle many objects in their habitat. Sea otters are physical learners and enjoy different textures and shapes they can manipulate with their paws. Sea otters like to take things apart. They can unscrew things. Sometimes they put their enrichment items in the filters. So make sure to consider these facts when designing your enrichment.

In the space below create an initial model for your sea otter enrichment item.

EXPLORE

Now that you have created your initial model for your otter enrichment, you should do some more research on sea otter habits. In order to collect data on an otter's behaviors, you will conduct something called an ethogram. An ethogram is a log or table of an animal's behavior over time. You will watch a video clip of the sea otters at Shedd Aquarium. You will stop the video every 5-10 seconds. Make sure to have the same amount of time between each time you pause the video. Each time you stop the video you will record the behavior of the otter in the table below. Some behaviors you might see would be swimming, grooming of fur and eating.

SEA OTTER BEHAVIORAL ETHOGRAM	
Time interval	**Behavior**
5 sec	
10 sec	
15 sec	

EXPLAIN

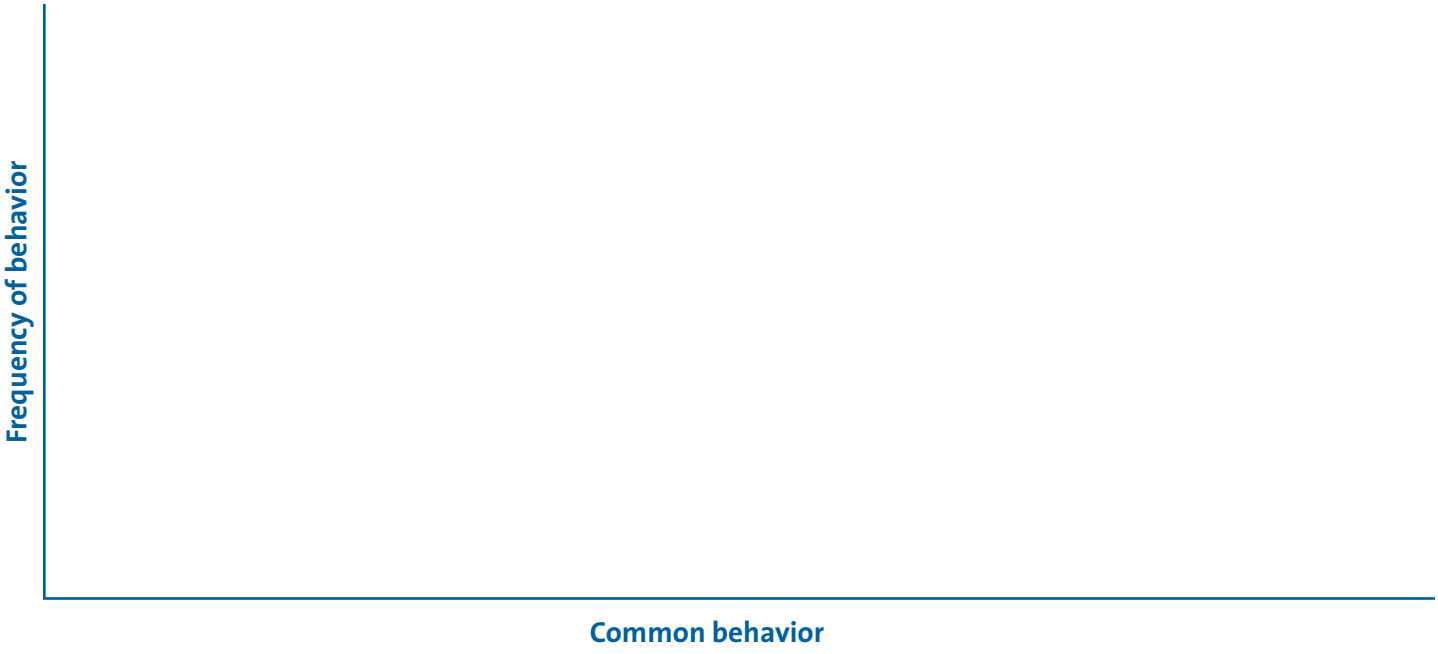
Use your completed ethogram to create different visual data representations. You will be creating both a bar graph and a pie chart. If you need help, there are directions for each data representation. Scientists call data expressed in words **qualitative** data, and numerical data or data with numbers is called **quantitative** data.

1. You collected data on two variables: an otter's behavior and the frequency of that behavior. Remember a variable is something you change or measure in an experiment. How would you define each of the variables: qualitative or quantitative? Make sure to support your claim with specific definitions.

Use the table below to summarize your ethogram. Pick the four most common behaviors you saw during your investigation. Record the behavior and how many times you saw the otter doing this behavior during the ethogram in the table below.

Common behavior	Total time doing behavior (seconds)

Create a bar graph using your table. Place the sea otter's common behaviors on the x-axis and total time it did the behavior (frequency) on the y-axis.



In the space below, you will make a pie chart. A pie charts requires percentages because it will show us what portion of the total time an otter does each behavior. So before it can be created, we need to figure out what percent of time the otter does each of its most common four behaviors. Use the space below to perform these calculations.

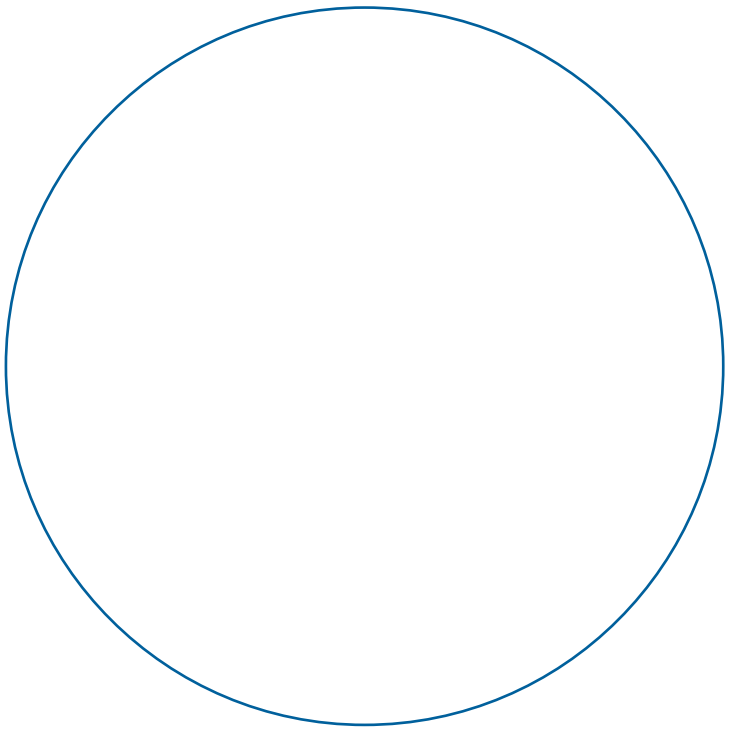
What is the number of times the otter did this? ONLY the four most common behaviors during the ethogram.

Total number of observations. Use the formula below to calculate the percentage for each individual behavior:

$$\frac{\textit{Number of times behavior was observed}}{\textit{Total number of observations made}} \times 100 = \underline{\qquad\qquad}\%$$

Use the space below to perform your calculations:

Create your pie chart. Make sure your "pie slices" reflect the time spent doing the behavior. So the more common the behavior the bigger the slice.



ELABORATE

Interpret your data by answering the following questions:

1. Alaska sea otters live in cold aquatic climates. Sea otters have the thickest fur of any animal in the world; because of the absence of blubber, sea otters depend entirely upon their fur for protection from the cold. One square inch of skin contains between approximately 750,000 and a million hairs! Use this information and your data on the previous page to create a claim or hypothesis on the reasons for some of the behaviors you observed.

2. What was the most common behavior you observed? Support your claim with specific quantitative evidence.

3. Now that you have collected some information about a sea otter's behaviors, you will redesign your otter enrichment activity or item. It is important that Shedd's enrichment materials are something that will naturally engage our animals. Based on your observations and data, brainstorm either some changes to your original enrichment or create a completely new one. Make sure you explain why you have made your alterations.

4. Why do scientists find it important to support their claims or hypotheses with specific quantitative data?

EVALUATE

In the space below, draw your new sea otter enrichment item:

5. What is the name and purpose of your sea otter enrichment item?

6. What behaviors are you encouraging? Are you incorporating any food that could appeal to sea otters?

7. What materials are you using?